STREAM INVENTORY REPORT

Kettenpom Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Kettenpom Creek. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Kettenpom Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonids and cyprinidae. There is no known record of adult spawning surveys having been conducted on Kettenpom Creek.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Kettenpom Creek is tributary to the North Fork Eel River, tributary to the Eel River, located in Trinity County, California. Kettenpom Creek's legal description at the confluence with North Fork Eel River is T03S R07E S27. Its location is 40°10'27" North latitude and 123°22'10" West longitude. Kettenpom Creek is a second order stream and has approximately 9.2 miles of blue line stream according to the USGS Shannon Butte, Zenia, and Long Ridge 7.5 minute quadrangles. Kettenpom Creek drains a watershed of approximately 15.1 square miles. Summer base flow is approximately 0.5 cubic feet per second (cfs) at the mouth, but over 10 cfs is not unusual during winter storms. Elevations range from about 1,880 feet at the mouth of the creek to 3,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily National Forest and is managed for timber production, rangeland, and dispersed recreation. Vehicle access exists via a light-duty road near Kettenpom Airstrip to a jeep trail that leads to Soldier Basin Trail at the mouth of Kettenpom Creek.

METHODS

The habitat inventory conducted in Kettenpom Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The Pacific Coast Fisheries, Wildlife and Wetlands Restoration Association (PCFWWRA) members that conducted the inventory were trained in

standardized habitat inventory methods by the California Department of Fish and Game (DFG). Kettenpom Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1994). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Kettenpom Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also

recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Additionally, a recording thermograph was deployed in Kettenpom Creek from July 22 to September 18, 1996 to record temperatures on a 24 hour basis during warm summer months.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Kettenpom Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Kettenpom Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 5) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Kettenpom Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according

to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two respectively.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Kettenpom Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Kettenpom Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Kettenpom Creek fish presence was observed from the stream banks. This sampling technique is discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically

beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes: 25.4, 12.5, 4.7, 2.37, and 0.85 mm (Valentine, 1995).

DATA ANALYSIS

Data from the habitat inventory form are entered into *Habitat*, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Kettenpom Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of October 8 and 9, 1996, was conducted by Dave Smith and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 8,841 feet with an additional 181 feet of side channel.

Flow was estimated to be 0.5 cfs during the survey period.

Kettenpom Creek is an F2 channel type for the entire 8,841 feet

of stream reach surveyed. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 64 degrees Fahrenheit. Air temperatures ranged from 51 to 82 degrees Fahrenheit. Water temperatures taken with a recording thermograph deployed from July 22 to September 18, 1996, ranged from 52° to 79° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 36% flatwater units, 34% pool units, and 30% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 56% flatwater units, 23% pool units, and 21% riffle units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 28%; mid-channel pools, 28%; and step runs, 25% (Graph 3). Based on percent total **length**, step runs made up 48%, mid-channel pools 20%, and low gradient riffles 19%.

A total of forty-nine pools were identified (Table 3). Main channel pools were most frequently encountered at 86% and comprised 89% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-seven of the 49 pools (96%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 49 pool tail-outs measured, one had a value of 1 (2%); 11 had a value of 2 (22%); 23 had a value of 3 (47%); none had a value of 4; and 14 had a value of 5 (29%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Pool habitat types had a mean shelter rating of 41, and flatwater habitats had a mean shelter rating of 34 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 75. Scour pools had a mean shelter rating of 51 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Kettenpom Creek and are extensive.

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Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Kettenpom Creek.

Table 6 summarizes the dominant substrate by habitat type. Bedrock was the dominant substrate observed in four of the six low gradient riffles measured (83%). Large cobble was the next most frequently observed dominant substrate type and occurred in 17% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 45%. The mean percentages of deciduous and coniferous trees were 92% and 8%, respectively. Graph 9 describes the canopy in Kettenpom Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 34%. The mean percent left bank vegetated was 34%. The dominant elements composing the structure of the stream banks consisted of 57.1% bedrock, 23.2% boulder, 16.1% cobble/gravel, and 3.6% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 43% of the units surveyed. Additionally, 44.6% of the units surveyed had deciduous trees as the dominant vegetation type, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Young-of-the-year (YOY) and juvenile (1+) steelhead rainbow trout were observed from the streambanks by the surveyors during the 1996 stream survey of Kettenpom Creek.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Kettenpom Creek.

DISCUSSION

Kettenpom Creek is an F2 channel type for the entire 8,841 feet of stream surveyed. The suitability of F2 channel types for fish habitat improvement structures is fair for low-stage weirs, single and opposing wing-deflectors, and log cover; and poor for medium-stage weirs.

The water temperatures recorded on the survey days October 8 and 9, 1996, ranged from 52 to 64 degrees Fahrenheit. Air temperatures ranged from 51 to 82 degrees Fahrenheit. Further samples from a recording thermograph deployed during the summer

of 1996 measured water temperatures ranged from 52° to 79° Fahrenheit. This is a warm water temperature range for salmonids. Temperatures above 68° F, if sustained, are near the threshold stress level for salmonids.

Flatwater habitat types comprised 56% of the total **length** of this survey, riffles 21%, and pools 23%. The pools are relatively deep, with 47 of the 49 (96%) pools having a maximum depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Twenty-three of the 49 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was low with a rating of 41. The shelter rating in the flatwater habitats was slightly lower at 34. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, bedrock ledges contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

All of the low gradient riffles had large cobble or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean percent canopy density for the stream was 45%. This is a relatively moderate percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was

low at 34% and 34%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Kettenpom Creek should be managed as an anadromous, natural production stream.

2) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

4) The limited water temperature data available suggest that maximum temperatures are above the optimum range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

5) Increase the canopy on Kettenpom Creek by planting willow, alder, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and measured from the beginning of the survey reach.

0' Begin survey at confluence with North Fork Eel River. Channel type is an F2 for the entire 8,841' of stream surveyed.

2309' Spring on left bank (LB) on stream.

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2419'Several California roach observed from the streambanks by surveyors.

2671'Young-of-the-year (YOY) steelhead rainbow trout observed from the streambanks.

2700'Failure on right bank (RB); 60' long x 25' high.

3208'Small tributary enters from LB. Temperature is 63°F.

3750'Vertical drop in stream elevation of 3.5 feet. Does not appear to be a barrier for migrating fish.

4764'Spring on LB.

7118'Bluff Creek enters stream from the LB. Temperature is 52°F.

7640'YOY steelhead rainbow trout and California roach observed from the streambanks.

8841'Channel becomes very steep. Very large boulders are blocking the stream; complete barrier to anadromous fish. End of survey.

References

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5